

IDS – Solidification Analysis Package for Steels

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ABSTRACT

IDS (InterDendritic Solidification) is a thermodynamic–kinetic–empirical tool for simulation of solidification phenomena of steels including phase transformations from melt down to room temperature. In addition, important thermophysical material properties (enthalpy, thermal conductivity, density, etc.) are calculated. The model has been developed in the Laboratory of Metallurgy, Aalto University (earlier Helsinki University of Technology), Finland, since 1984. IDS includes two main modules, the IDS module and the ADC (Austenite DeComposition) module. IDS module simulates the solidification phenomena from liquid down to 1000 °C and ADC the austenite decomposition down to room temperature. Both modules have their own recommended composition ranges. The IDS module is based on the so-called sharp interface concept. The ADC is mainly statistical based on empirical CCT (Continuous Cooling Transformation) diagrams. IDS tool is also coupled with the thermodynamic programmer's library, called ChemApp, developed by a German company, GTT-Technologies. This coupled package is used to simulate among other things multiphase inclusions during solidification. The present IDS package includes the following calculation modules:

- SOL: simulation of solidification
- ADC: simulation of austenite decomposition
- MAT: calculation of temperature functions for material properties
- GAS: calculation of hydrogen and nitrogen solubility, pressure and diffusivity
- HOM: simulation of homogenization

The package also contains a data bank, which include the material data needed in calculations (parameters for Gibbs energy, enthalpy, diffusion, microstructure, thermal conductivity, density and liquid viscosity). In the near future, the IDS tool and ChemApp will be coupled with the ladle treatment simulation models so that the formation of inclusions and the steel cleanness can be simulated from ladle treatment to as-cast structure and then even further to hot rolling.

The presentation summarizes the features of the IDS tool including the coupling with the ChemApp library.